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Perspectives on disposable and reusable surgical materials in laparoscopic surgery: a global survey amongst surgeons

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Background: Surgical practices generate substantial waste due to disposable materials. Reusable alternatives have the potential to substantially reduce emissions, yet their implementation has been slow. This study investigates reasons for this by examining surgeons' perspectives on using disposable and reusable materials during laparoscopic cholecystectomy (LC).

Materials and methods: A survey, containing both quantitative and qualitative questions, targeted surgeons' perceptions of sustainable healthcare in general and reusable versus disposable instruments (trocars, clip applicators, drapes, and gowns) in LC. Quantitative data was analyzed by experience level, hospital type, and WHO regions.

Conclusion: The survey was completed by 594 surgeons from 75 countries. While 82.3% supported reducing surgery's environmental impact, only 48.7% considered sustainability when selecting instruments. Limited availability of reusables was a major issue, with only 52.3% having access to reusable trocars, and fewer than 30% to reusable drapes and gowns. Availability was reported to be lower in Europe compared to other WHO regions. Availability, cost-effectiveness, and quality are reported as necessary factors for transitioning to reusable materials.

Interpretation: Surgeons are willing to use more reusable surgical materials in LC, but limited access and quality issues are major concerns. These findings offer valuable international insights into the current use of reusables, empowering surgeons to advocate for improved access and quality while driving the development and adoption of sustainable surgical practices.

Keywords: disposable, instruments, laparoscopic surgery, reusable, sustainability

Introduction

Climate change poses a critical threat to human health and well-being, with healthcare being a major contributor. The sector accounts for over 4.4% of global carbon emissions, with Northern Hemisphere countries responsible for 6–10% of local national emissions[1-5]. Surgical practices, particularly in operating rooms, generate over 30% of hospital solid waste and 70% of regulated medical waste, leading to significant carbon emissions[6,7]. To align with the United Nations's goal of reducing GHG emissions by 45% by 2030, increasing sustainable surgical practices is essential[8].

Laparoscopic cholecystectomy (LC), e.g., performed around 60 000 times annually in the United Kingdom, is a highly standardized procedure and ideal for evaluating the environmental impact of surgical practices[9]. Comes *et al* estimated that one LC in the Netherlands generates 56.5 kg CO_2 equivalents (CO_2-eq), with surgical disposables being the major contributor, accounting

HIGHLIGHTS

- Surgeons acknowledge their responsibility to reduce surgery's environmental impact.
- Survey of 594 surgeons from 75 countries on disposable vs. reusable materials.
- Reusable availability varies, with gowns least available (32.5%).
- Most prefer reusables (53.7–85.2%), citing cost-effectiveness and sustainability.
- Barriers to adapt reusables include availability, quality, and infection concerns.

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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for 40% of the total emissions. Among these disposables, four items contribute to 65% of the total disposable carbon footprint: surgical drapes accounting for 28%, surgical gowns for 19%, and trocars and clip applicators collectively for 18%[10]. Similarly, Rizan *et al* identified disposable items as a major contributor to LC emissions in England, adding 20 kg CO_2-eq[11]. Other studies have reported comparable findings in various minimally invasive procedures, with carbon emissions ranging from 6 to 814 kg CO_2-eq, depending on the procedure type and geographical context[12-14]. Switching to reusable instruments, which have 40–66% lower emissions, offers a promising opportunity to reduce the environmental impact of LC, given that many surgical instruments are available in both reusable and disposable variants[11-15].

Although much is known about the environmental impact of surgical practices, the transition toward more sustainable practices remains slow[16]. While there is a broad desire within the surgical field to adopt more sustainable practices, hesitation persists about reducing the use of disposable materials[17-24]. Understanding surgeons' perspectives on disposable and reusable surgical items, as well as identifying their concerns, is essential for shaping effective implementation strategies[23]. Surgeons' attitudes are pivotal, as they may influence operating room policies, guide team behaviors, and drive the adoption of new practices. A global approach to this matter is particularly valuable, enabling the comparison of perspectives across healthcare systems, cultural contexts, and resource settings, thereby providing insights into the unique challenges faced in different parts of the world[25]. By addressing these varied concerns and perspectives, tailored strategies can help overcome barriers, build confidence in sustainable practices, and accelerate the transition toward environmentally friendly surgical practices.

To support the transition toward a more sustainable surgery, this study aims to gain insight into surgeons' perspectives on the environmental impact of surgical practices, as well as the availability and use of disposable and reusable materials – trocars, clip applicators, drapes, and gowns – during LC. By understanding these considerations, this study aims to inform surgeons and other stakeholders – such as policymakers, hospital management, and industry representatives – about current practices regarding the use of reusable surgical materials. It also provides insights into existing concerns, stimulating surgeons to engage and collaborate in developing and adopting sustainable surgical practices.

Methods

Study design

A multidisciplinary team, including surgeons (N.B., P.R.) and social psychologists (C.B., M.C., F.H.), developed a survey with both quantitative (predominantly 5-point Likert scales) and qualitative (free-text) questions[26].

The survey was developed based on the results of a life cycle assessment (LCA) of LC, a review of various studies, existing questionnaires on climate change in healthcare and with a particular focus on surgery[10-26], [27-29]. We included four categories of disposable items – trocars, clip applicators, surgical drapes, and surgical gowns – identified in a LCA as major contributors to the carbon footprint of LC[10].

The 45-question English survey comprised six sections: (1) demographics; (2) general perspectives on surgery's environmental impact; views on reusable versus disposable; (3) trocars; (4) clip applicators; (5) surgical drapes; and (6) surgical gowns. The questionnaire is provided in Supplemental Digital Content Appendix 1 (available at: http://links.lww.com/JS9/E143).

The survey was piloted with six surgeons from two Dutch hospitals, and feedback was incorporated into the final version. Pilot testing indicated a completion time of about 10 minutes. Participants gave informed consent before starting; those who declined consent or were not practicing as surgical residents, fellows, or attendings were excluded. In total, 768 participants started the survey, of which 174 participants were excluded (details are provided in Supplemental Digital Content Appendix 2, available at: http://links.lww.com/JS9/E144).

Ethical approval was not required, as the study did not meet the criteria defined by the Medical Research Human Subjects Act. Participants' anonymity was maintained, as no personally identifiable information was collected beyond the demographic data summarized in Table 1. Data were securely collected and stored in compliance with institutional privacy policies.

Contact procedure, data collection, and participants

The survey targeted a general surgical population and was distributed via a Qualtrics® link and QR code at three conferences in 2024: the International Hepato-Pancreato Biliary Association (IHPBA, Cape Town, South Africa), the European Association for Endoscopic Surgery Congress (EAES, Maastricht, Netherlands), and Surgery Days (Dutch Society for Surgery, NVvH, Veldhoven, Netherlands). It was also disseminated through newsletters of professional organizations, including IHPBA, EAES, NVvH, the Japan Society for Endoscopic Surgery, and the Swedish Surgical Society, as well as the authors' global network. The survey was open from May to September 2024.

Table 1

Demographic characteristics of participants (N = 594)

	n (%)
Gender	
Male	420 (70.7%)
Female	170 (28.6%)
Prefer not to say	4 (0.7%)
Prefer to describe myself as…	0 (0%)
Experience level	
Surgical resident	91 (15.3%)
Fellow	41 (6.9%)
Attending 0–5 years	91 (15.3%)
Attending 6–10 years	85 (14.3%)
Attending >10 years	286 (48.1%)
Hospital type	
Local community hospital	118 (19.9%)
Teaching hospital	207 (34.8%)
Academic hospital	269 (45.3%)
Number of laparoscopic cholecystectomies per year	
0	27 (4.5%)
1–4	29 (4.9%)
5–20	129 (21.7%)
21–99	289 (48.7%)
100 or more	120 (20.2%)

Analysis

Data were analyzed using SPSS® 27.0. Absolute frequencies and percentages were calculated to summarize responses, including concerns about reusable instruments, where up to two concerns could be selected from a predefined list, including "no concerns" (Q23, Q30, Q37, Q44).

To explore group differences, variables were analyzed across the following categories: (1) WHO regions [Region of the Americas (AMR), European Region (EUR), Eastern Mediterranean Region (EMR), African Region (AFR), South-East Asian Region (SEAR), and Western Pacific Region (WPR)]; (2) experience level (resident, fellow, attending with 0–5, 6–10, and >10 years of experience); and (3) hospital type (local community, teaching, or academic hospital). Differences in responses based on experience level and hospital type were analyzed using Kruskal–Wallis tests, as the non-normal distribution of data was confirmed by Kolmogorov-Smirnov and Shapiro-Wilk tests ($P < 0.001$ *for all groups*). Post-hoc analysis was conducted with Mann-Whitney U tests, and statistical significance was set at $P < 0.05$.

The Borda count method was applied to rank initiatives from most to least likely to be implemented in daily surgical practice (Q13), assigning points based on preferences: five points for the first choice, down to one point for the fifth. Open-ended responses were analyzed thematically. Responses were reviewed and coded, with codes grouped into overarching themes to contextualize the quantitative findings.

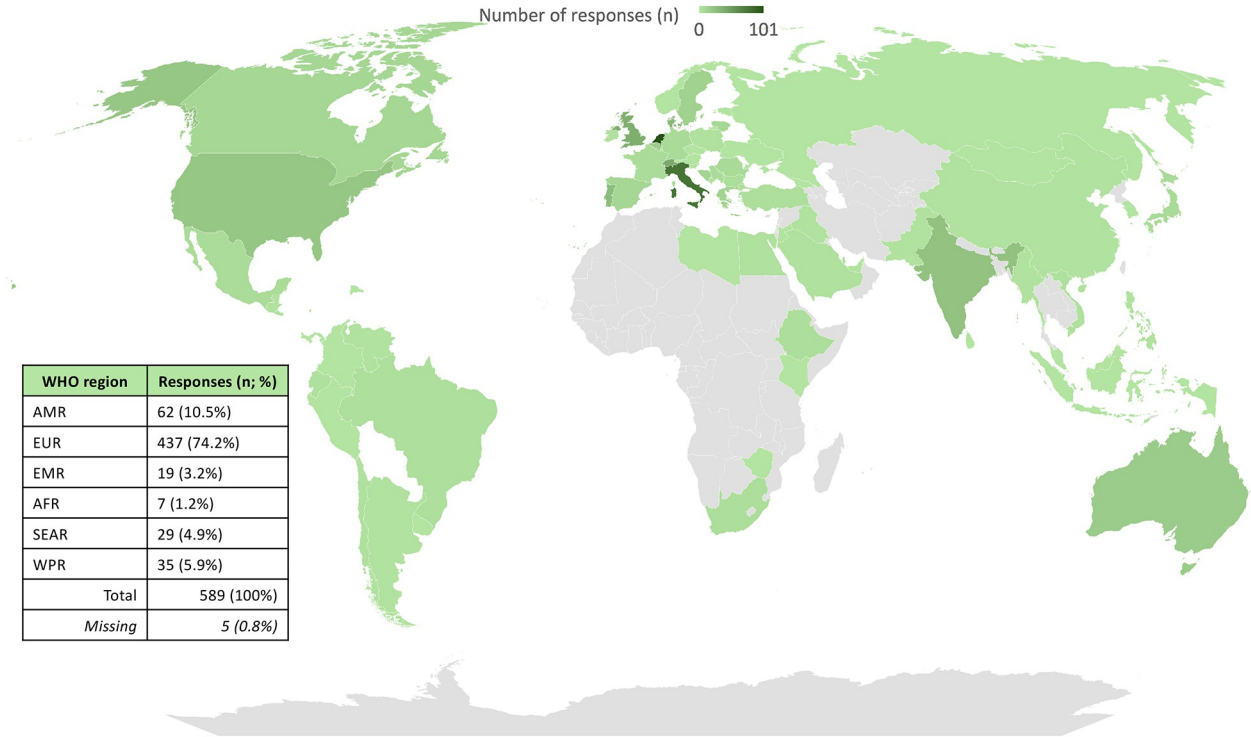
Results

Demographics and geographical distribution

The final sample consisted of 594 surgical attendings, fellows, and residents from 75 countries. The average participant age was 45 years (SD 11.2), with 70.7% male (420/594). Details on experience level, hospital type, and the number of annual laparoscopic cholecystectomies performed are provided in Table 1. Figure 1 shows response rates per World Health Organization (WHO) region. Appendix 3 (available at: http://links.lww.com/JS9/E145) provides country-specific response rates from 75 countries.

Consideration of environmental impact in the choice of surgical equipment

Most participants agreed on the need to reduce the environmental impact of surgical practice (Q7, score ≥4: 82.3%; 489/594), and 74.1% agreed to feel responsible for addressing it (Q8, score ≥4: 440/594). Nearly half agreed that they consider environmental impact when selecting surgical instruments (Q9, score ≥4: 48.7%; 289/594). The majority disagreed that sustainable practices are not worth the strain on healthcare (Q10, score ≤2: 61.8%; 367/594). Forty percent agreed to feeling that transitioning to sustainable care would require significant effort on their part (Q11, score ≥4: 237/594). Over half were neutral or disagreed with the statement that colleagues are supportive of changing toward more sustainable practices (Q12, score ≤3:



WHO region	Responses (n; %)
AMR	62 (10.5%)
EUR	437 (74.2%)
EMR	19 (3.2%)
AFR	7 (1.2%)
SEAR	29 (4.9%)
WPR	35 (5.9%)
Total	589 (100%)
Missing	*5 (0.8%)*

Figure 1. Response rate per country. AMR = Region of the Americas; EUR = European Region; EMR = Eastern Mediterranean Region; AFR = African Region; SEAR = South-East Asian Region; WPR = Western Pacific Region. The number of responses is represented using a color gradient, with darker green indicating higher response rates. Grey represents the absence of responses from that country.

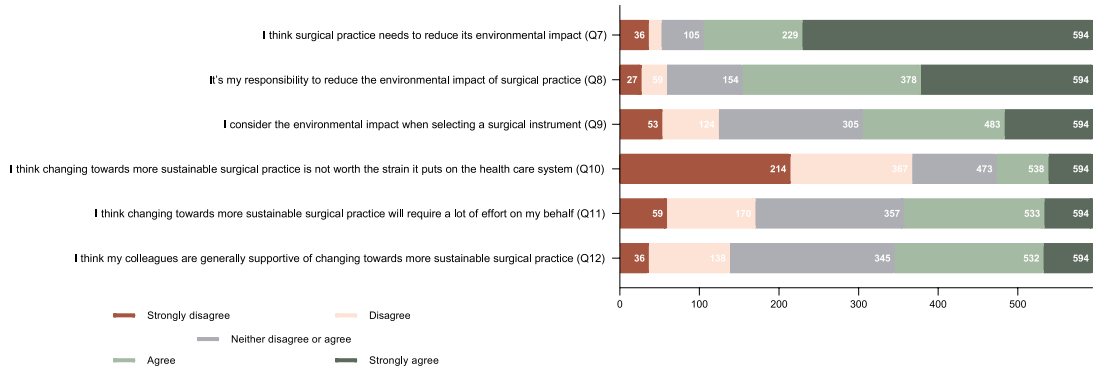


Figure 2. Response to environmental considerations (N = 594). Numbers indicate cumulative absolute response rates.

58.1%; 345/594). See Fig. 2 and Appendix 4 (available at: http://links.lww.com/JS9/E146) for details.

Differences in WHO regions, experience levels, and hospital types

Disagreement on the need to reduce surgery's environmental impact was low across regions (Q7, score ≤2: 5.3–11.3%), except in Western Pacific Region (WPR) (Q7, score ≤2: 20%; 7/35). Agreement on personal responsibility was high (score ≥4: 57.1–93.1%) (Q8). In Eastern Mediterranean Region (EMR), agreement on considering environmental impact was highest (score ≥4: 73.7%; 14/19). South-East Asian Region (SEAR) showed the highest disagreement with the statement that sustainability is not worth the strain (Q10, score ≤2: 75.9%; 22/29). Agreement that sustainability requires effort ranged from 36.9% to 58.6%, peaking in African region (AFR) (Q11, score ≥4: 71.4%; 5/7). Perceived colleague support was strongest in AFR, SEAR, and WPR (Q12, score ≥4: 57.1–58.6%). See Appendix 4 (available at: http://links.lww.com/JS9/E146) for details.

Regarding experience levels and hospital types, significant differences were found for Q9 (considering environmental impact), Q12 (perceived colleague support), and Q10 (beliefs about sustainability changes not being worth the strain on healthcare). For Q9, $\chi^2(4) = 10.65$, $p = 0.031$, attendings with over 10 years of experience had the highest mean rank (319.29), scoring significantly higher than attendings with 6–10 years (U = 10012.00, z = −2.55, $p = 0.011$) and surgical residents (U = 11002.50, z = −2.30, $p = 0.022$). No other significant differences were observed. For Q12, $\chi^2(4) = 13.49$, $p = 0.009$, attendings with over 10 years scored significantly higher than attendings with 6–10 years (U = 9649.50, z = −2.99, $p = 0.003$). No other significant differences were found. For Q10, $\chi^2(2) = 16.27$, $p < 0.001$, local community hospitals had the highest mean rank (327.00), indicating that surgeons there were more likely to believe sustainability changes are not worth the strain on healthcare, compared to surgeons at teaching hospitals (U = 9625.50, z = −3.33, $p < 0.001$). Conversely, surgeons at academic hospitals were less likely to hold this belief compared to those at teaching hospitals (U = 22828.00, z = −3.51, $p < 0.001$).

Availability of reusable materials

The reported availability of reusable instruments was 52.3% (283/541) for trocars, 74.1% (401/541) for clip applicators, 26.1% (141/541) for drapes, and 27.4% (148/541) for gowns. Prior but no current availability was reported as 34.8% (188/541), 15.3% (83/541), 43.1% (233/541), and 38.8% (210/541), respectively (Q14–Q17). Availability was lower in the EUR compared to other WHO regions, at 46.9% (183/390) for trocars, 71.5% (279/390) for clip applicators, 20.0% (78/390) for drapes, and 20.3% (79/390). Detailed regional data is provided in Appendix 5 (available at: http://links.lww.com/JS9/E147).5pt?>

Usage, perceptions, and barriers for reusable trocars

Among 283 respondents with access to reusable trocars, 73.1% (Q18: 207/283) used them often or always, 67.5% (Q19, score ≥4: 191/283) were satisfied or very satisfied, and 69.9% (Q20, score ≥4: 375/536) preferred them over disposables. A total of 227 participants reported at least one concern, with 447 concerns selected overall. The top three concerns were quality maintenance, functionality, and patient safety (excluding infection risk) (Q23), as shown in Fig. 3a.

In response to qualitative questions, participants mentioned several positives of using reusable trocars during LC, including cost savings, environmental benefits, consistent availability, and ergonomic advantages. Other benefits included reliability, durability, ease of handling, user familiarity, enhanced confidence, comparable quality to disposable alternatives, and the potential for smaller incisions (Q21). Reported negatives included air leaks, wear and tear, frequent sterilization, cost concerns, infection risks, heavier weight, instrument slippage, and reduced visibility (Q22).

In the qualitative question about what would facilitate switching to reusable trocars, respondents emphasized the need for availability, cost, quality improvements, better fixation, improved valves, smoother handling, evidence of reduced environmental impact, and institutional support (Q24).

Usage, perceptions, and barriers for reusable clip applicators

Among 401 respondents with access to reusable clip applicators, 78.5% (Q25: 277/353) used them often or always, 85.2% were satisfied or very satisfied (Q26, score ≥4: 301/353) and 85.2% agreed on preferring them over disposables (Q27, score ≥4: 301/353). A total of 219 participants reported at least one concern, with 446 concerns selected overall. The top three concerns were

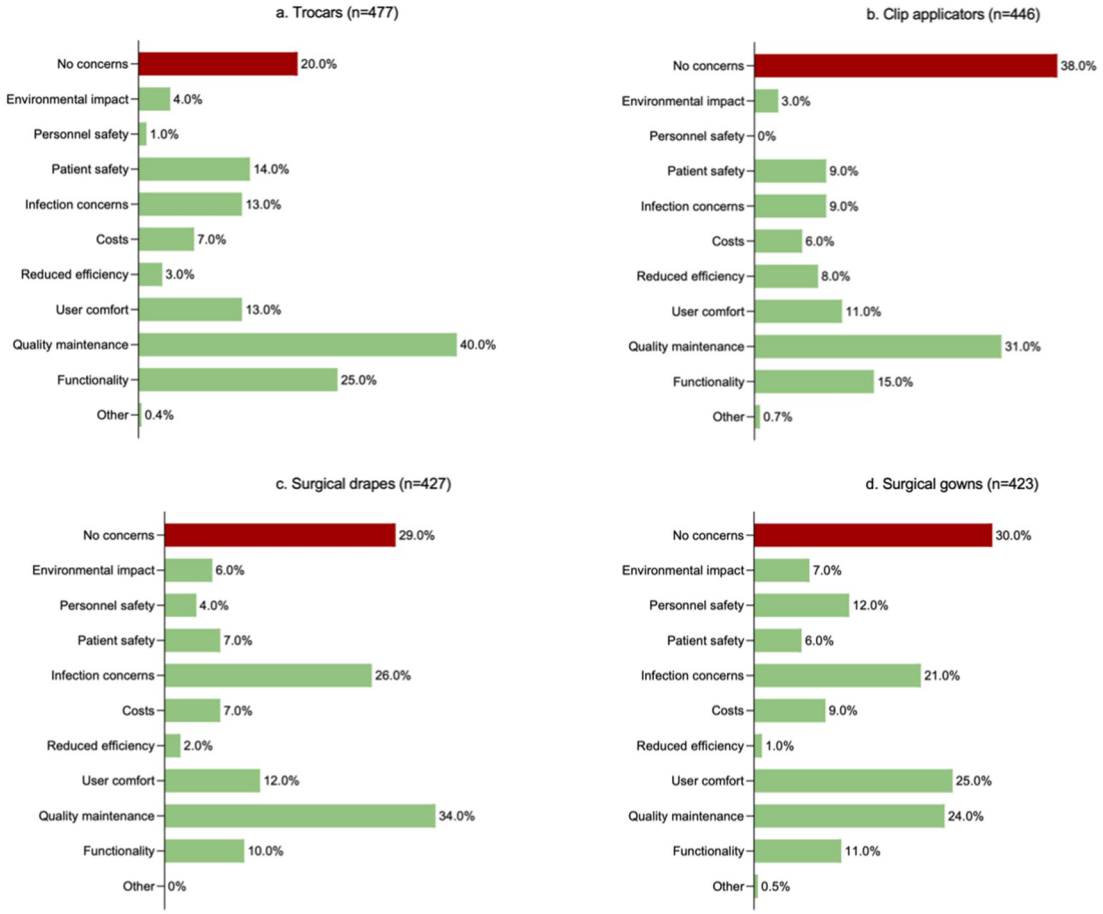


Figure 3. Percentage of reported concerns about reusable products compared to disposable ones. Participants could select up to two concerns from a predefined list, including the option no concerns and other.

quality maintenance, functionality, and user comfort (Q30), as shown in Fig. 3b.

Respondents described cost savings, environmental benefits, reliability, durability, good tactile feedback, stronger grip, improved safety, consistency, availability, and familiarity as positives of reusable clip applicators (Q28). Reported negatives included time-consuming clip reloading, wear and tear causing malfunctions, and ergonomic issues such as bulkiness and handling difficulty (Q29).

To facilitate a switch to reusable clip applicators, respondents highlighted availability, cost-effectiveness, quality improvements (e.g., automatic reloading, better maintenance), training, institutional support, and demonstrated environmental benefits (Q31).

Usage, perceptions, and barriers for reusable surgical drapes

Among 114 respondents with access to reusable drapes, 76.4% (Q32: 87/114) used them often or always, 75.4% (Q33, score ≥4: 86/114) were satisfied or very satisfied, and 53.7% agreed on preferring them over disposables (Q34, score ≥4: 237/441). A total of 313 participants reported at least one concern, with 427 concerns selected overall. The top three concerns were quality maintenance, infection risk, and user comfort (Q37), as shown in Fig. 3c.

Reported positive aspects of using reusable drapes included long-term cost-effectiveness, environmental benefits, comparable effectiveness, durability, and better fluid absorption (Q35). Negative aspects included sterility concerns, wear and tear leading to holes and compromised sterile fields, heaviness, discomfort, slippage, poor adhesion, maintenance costs, and the environmental impact of washing and sterilizing (Q36).

To facilitate a switch to reusable variants, respondents mentioned the need for availability, lower costs, quality improvements (e.g., better adhesion, waterproofing), institutional support, and evidence of safety and sustainability (Q38).

Usage, perceptions, and barriers for reusable surgical gowns

Among 283 respondents with access to reusable gowns, 32.5% (Q39: 92/283) used them often or always, 50.6% (Q40, score ≥4: 143/283) were satisfied or very satisfied, and 57.2% (Q421, score ≥4: 243/425) agreed on preferring them over disposables. A total of 295 participants reported at least one concern, with 423 concerns selected overall. The top three concerns were user

comfort, quality maintenance, and infection risk (Q44), as shown in Fig. 3d.

In the open questions, respondents highlighted environmental and cost benefits of reusable gowns, along with comfort, breathability, durability, better liquid absorption, and reduced perspiration (Q42). Negatives included discomfort during long surgeries due to heaviness and warmth, infection control concerns (e.g., hygiene, wear and tear, material degradation), and doubts about their cost-effectiveness and environmental benefits due to frequent washing (Q43).

To switch to reusable gowns, respondents cited the need for better availability, lower costs, institutional support, assurances of proper sterilization, measurable environmental benefits and quality improvements, especially in comfort and durability (Q45).

Likelihood of implementing reusables in surgical practice

Among 560 participants, Borda count analysis ranked switching to reusable trocars, clip applicators, drapes, using smaller drapes, and reusable gowns from most to least likely for daily implementation (Q13) (Fig. 4).

Discussion

In the present study we explored surgeons' perspectives on reducing the environmental impact and availability of reusable instruments for laparoscopic cholecystectomy. We employed a diverse global sample of 594 surgeons across all WHO regions, with varied experience levels and hospital types, providing a reasonable representation of surgical practice. The study aimed to comprehensively explore perspectives through a survey that combined a wide range of quantitative and qualitative questions.

The results of the study highlight the willingness of surgeons to transition toward reusable instruments, but point toward challenges. Surgeons acknowledge their responsibility to reduce the environmental impact of surgical practices. Satisfaction with reusables is high among users (67.5–85.2%), except for surgical gowns, but concerns about quality, safety, functionality, sterility, and durability remain. Despite this, only around half of surgeons considered environmental impact in instrument selection. By identifying the barriers to adopting reusable materials, this survey contributes to the transition toward sustainable surgery, highlighting the need for collaboration among surgeons, healthcare institutions, and industry to develop and offer high-quality, cost-effective, and environmentally sustainable solutions.

Experienced surgeons, especially those with over 10 years of practice, might play a pivotal role in advancing sustainability. This group is more likely to consider environmental impact in their instrument selection, and perceive greater support from colleagues. Their leadership could position them to drive change, foster adoption of reusables, and mentor the next generation of surgeons on sustainable decision-making. However, our results indicate different potentials for contribution at different levels of experience, with junior surgeons prioritizing environmental considerations more than mid-career surgeons. Future research should explore how career stages shape attitudes, fostering leadership and mentoring to drive sustainable practices in surgery.

Regional disparities complicate adoption. For example, surgeons in the EUR strongly support reducing the environmental impact of surgical practices but report to experience limited access to reusable instruments, relying heavily on disposables. In this survey, over half of surgeons reported lacking access to reusable trocars, and nearly 80% lacked access to reusable drapes and gowns, underscoring the need for improved access and infrastructure. Addressing these gaps is crucial, especially in regions like the EUR, where improved access could set a strong example for global sustainability efforts.

Barriers to adopting reusable surgical instruments include concerns about quality, safety, functionality, infection risks, and user comfort – particularly with gowns, which are often criticized for discomfort during long procedures, sterility concerns, and material degradation. Similar challenges have been described in prior studies, but recent advancements show that reusables can outperform disposables, highlighting a gap between surgeon perceptions and current evidence, likely due to outdated experiences or misconceptions[30-32]. For trocars, air leaks and frequent sterilization requirements raise concerns about functionality and maintenance costs. Interestingly, some surgeons reported no specific concerns and even despite mentioned challenges, satisfaction with reusables remains high, especially for trocars, clip applicators, and surgical drapes, with many surgeons indicating they would favor them when available. Reusable trocars are especially valued for their reliability and ergonomic benefits, although maintenance concerns persist. Given that surgeons express specific concerns, it underscores the importance of balancing technical evaluations with end-user insights, such as ease of use and adaptability in clinical practice. To increase adoption, it is also essential to enhance the quality and usability and provide robust evidence of their cost-effectiveness and environmental benefits. Collaboration between surgeons and industry stakeholders

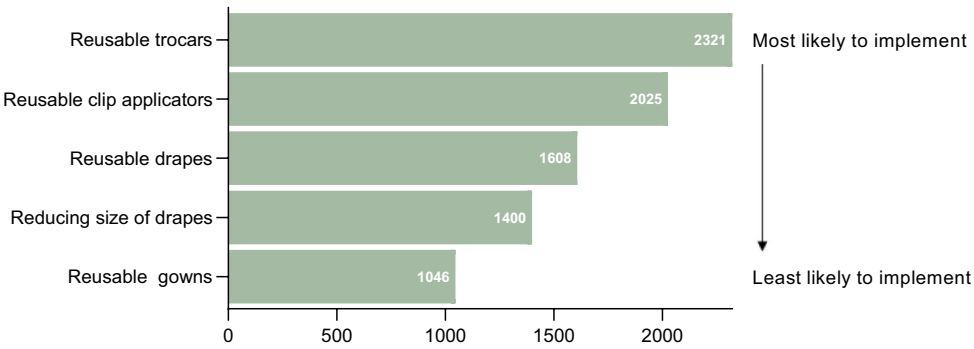


Figure 4. Ranked-choice preferences for implementing initiatives (N = 560) analyzed by the Borda count method.

should refine existing instruments and develop solutions that address clinical, economic, and environmental needs. Future research should prioritize improving usability, comfort, and reliability while integrating end-user perspectives to ensure practical and sustainable outcomes.

Broader acceptance of reusables will also require evidence-based strategies demonstrating cost and environmental savings. Despite perceived high initial costs and logistical demands, studies show reusable instruments in endoscopic surgery are often more cost-effective than disposables[33]. LCA combined with cost analyses provides clear evidence of their benefits. Future research should integrate both approaches to offer a more comprehensive evaluation[14]. Raising awareness and evaluating instruments for clinical, economic, and environmental impacts are critical for fostering broader adoption.

However, this study has limitations. The survey's distribution through professional networks may have introduced selection bias, attracting surgeons more engaged in sustainability, potentially overestimating the willingness to adopt reusables. Additionally, with three-quarters of responses from Europe, the findings may not fully represent global perspectives, particularly in regions where access to laparoscopic surgery remains limited. Furthermore, the reported availability of reusable and disposable materials reflects surgeons' awareness of what is available during surgery rather than an objectively confirmed hospital inventory. Future research should also explore patients' perspectives on this topic. In this survey, we focused on surgical instruments identified as major contributors to emissions based on LCA data[10]. However, reusable alternatives exist beyond these specific instruments, and additional mitigation strategies, such as optimizing anesthesia practices and reducing energy consumption, should also be considered in future sustainability efforts. Beyond reusable adoption, the "refuse" concept from the 10R framework – eliminating unnecessary items – is a highly effective emissions reduction strategy[34]. Questioning the necessity of devices like the Bair Hugger or diathermy in LC may have a greater impact than switching to reusables, though this was beyond our survey's scope. More broadly, minimizing low-value procedures, as emphasized by Choosing Wisely, is crucial for sustainable surgical practices[35]. To ensure a globally inclusive approach to sustainability, future research should conduct deeper regional comparisons to identify both barriers and opportunities for implementing sustainable surgical practices.

In conclusion, our study underscores surgeons' global commitment to sustainability, with the level of experience playing a role in shaping these efforts. Despite the availability of reusable options, challenges such as limited access, maintenance demands, and concerns about quality and safety persist. Emphasizing cost savings, environmental benefits, and durability can foster greater adoption. Strengthening advocacy and addressing supply chain barriers are essential steps forward. Future research should provide robust evidence of the cost-effectiveness and ecological benefits of reusables to support the global transition to sustainable surgical practices.

Ethical approval

Ethical approval was not required, as the study did not meet the criteria defined by the Medical Research Human Subjects Act.

Consent

Participants gave informed consent before starting the online survey; those who declined consent were excluded.

Sources of funding

Prof. Dr. Nicole Bouvy received a grant from the NWO (Dutch Research Council) for the CAREFREE consortium to support research on sustainability in the operating room.

Author contributions

M.E., S.B., and M.C. had full access to all data in the study and take responsibility for the integrity of the data and accuracy of data analysis. M.E., S.B., M.C., C.B., F.v.H., N.B., and P.d.R.: study concept and design; M.E., S.B., M.C., F.v.H., N.B., and P.d.R.: drafting of the manuscript; E.K., T.S., F.v.H., N.B., and P.d.R.: study supervision; all authors: acquisition, analysis, and interpretation of the data, and reviewing the manuscript.

Conflicts of interest disclosure

The authors report no conflicts of interests.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

Myrthe Eussen and Stijn Bluiminck.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Data availability statement

Datasets generated during and/or analyzed during the current study are available upon reasonable request.

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